In vitro evaluation of the capacity of a monofilament debrider* to remove biofilm and the efficacy of different wound dressings to prevent biofilm re-growth

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Introduction

Development of biofilms on wounds is a major impediment to wound healing. Therefore, current research targets antibiofilm strategies to restore an optimal wound-healing environment. Combined treatment involving debridement and addition of antibacterial agents may provide the highest success rates. A monofilament debrider* consisting of polyester fibres presents a fast and almost painless option for debridement and removal of biofilm. We have then analyzed the re-growth properties of biofilm underneath different wound dressings.

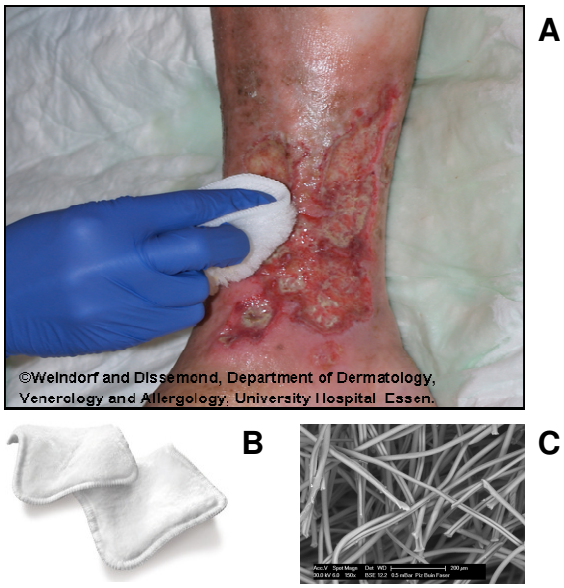

Figure 1: Mechanical debridement (A) with the monofilament debrider* (B). The debrider consists of polyester monofilament fibres (C).

Material & Methods

A *S. aureus* biofilm was cultivated on glass plates (figure 2). The monofilament debrider* was used to wipe the glass plates under standardized conditions (p=0.067N/cm², v=1.6cm/s). Afterwards, glass plates were covered with various antimicrobially active wound dressings# and incubated for 24h at 37°C. Then, dressings were removed and glass plates further incubated for 48h. Biofilm on the glass plates was evaluated directly after dressing removal and following 48h re-growth period using the fluorescent alamar blue assay.

*Debrisoft®, Lohmann & Rauscher
#A: Vliwasorb® (Lohmann & Rauscher), B: Vliwaktiv® (Lohmann & Rauscher), C: Vliwaktiv® Ag (Lohmann & Rauscher), D: Suprasorb® A (Lohmann & Rauscher), E: Suprasorb® A + Ag (Lohmann & Rauscher), F: Suprasorb® X (Lohmann & Rauscher), G: Suprasorb® X + PHMB (Lohmann & Rauscher), H: Suprasorb® P (Lohmann & Rauscher)

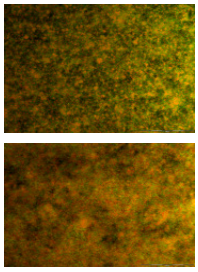

Figure 2: Mature *S. aureus* biofilm on glass plates after 48 hours of incubation stained with SYTO-9/PI.

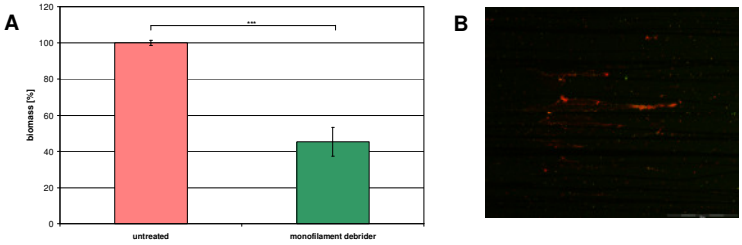

Figure 3: Removal of biomass by the monofilament debrider* (A). (B) shows a representative example of a glass plates after cleansing.

Results

It was shown that the monofilament debrider* effectively removed biofilm *in vitro* (figure 3). Furthermore, it was observed that subsequent treatment with wound dressings reduced formation of new biomass (figure 4). Significantly fewer bacteria were found after incubation with dressings containing antimicrobials like silver or polihexanide. Polihexanide-containing dressings further exhibited a persistent decrease of biofilm re-growth, while biofilm quickly reformed in untreated controls and after removal of antimicrobial-free and silver-containing dressings (figure 5).

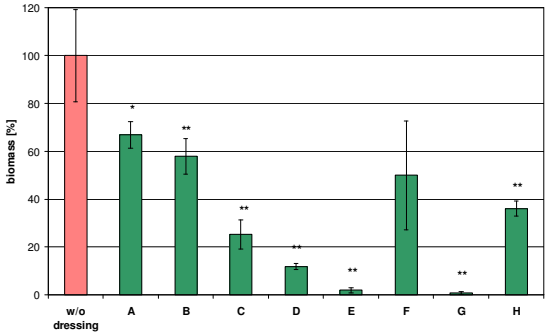

Figure 4: Decrease of biomass on the debrided glass plates by incubation with different wound dressings for 24 hours at 37°C.

Conclusion

It can be concluded that the combination of biofilm removal on the infected or critically colonized wound using a monofilament debrider* and subsequent treatment with antimicrobial dressings presents a successful antibiofilm strategy.

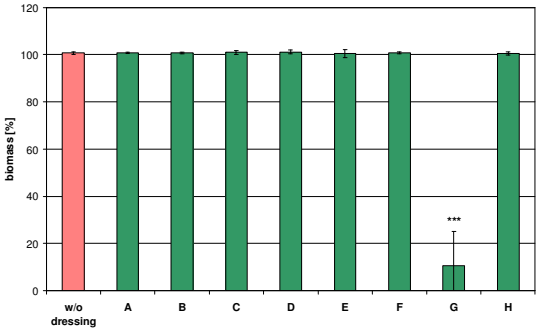

Figure 5: Regrowth of biomass is significantly inhibited after 48 hours by the PHMB-containing dressing G.

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